XXI. NOTES ON THE LAND-SHELLS OF THE ISLANDS AT THE WESTERN END OF LAKE ERIE AND DESCRIPTIONS OF NEW VARIETIES.

By George H. Clapp.

Many of the larger shells of these islands show distinct insular modification, so distinct in fact as to make them readily recognizable when once seen. Others are indistinguishable from the mainland forms, and this is particularly true of the shells of Put-in Bay, where there seems to have been no change in the species we found.

Both Dr. Walker and Mr. Goodrich, who have carefully gone over these shells, and to whom I am indebted for valuable suggestions, agree with me in considering the forms described below as worthy of varietal rank.

1. **Pyramidula solitaria strontiana** var. nov.

Shell very heavy, coarsely striate, *uniform straw-color without a trace of bands.* Most specimens show traces of impressed spiral lines. This variety is much more elevated, heavier, and smaller than the typical banded form from the mainland, and, as it is found in many of the older collections of North American land-shells, the locality being given as "Strontian Island, Lake Erie," I have thought it well to perpetuate the name, although the island is now "officially" known as Green Island.

We collected several hundred specimens on our visit to the island, July 3, 1915, and thousands could easily have been gathered.

Ninety-nine mature shells, that is those showing a thickening of the lip, were measured with the following result:

Diam. 24.3, Alt. 17.66 mm., Index, $\frac{A}{D}$, 72.65 average,

" 27.5, " 21.00 " " 76.36 largest,
" 22.5, " 17.00 " " 75.56 smallest,
" 26.0, " 20.50 " " 78.85 most elevated,
" 25.0, " 16.50 " " 66.00 " depressed.

Variation in diam. from 22.5 to 27.5 or 5 mm.
" " alt. " 16.0 " 21.0 " 5 "

Ninety-five shells varied in diam. from 23.0 to 26.5 or 3.5 mm.
Ninety-four " " " alt. " 16.0 " 19.0 " 3.0 "

For comparison nineteen shells from seven mainland localities were measured. They gave an average diameter of 26.75 mm. and an index of 69.35, the greatest index being 72.8.

Type-locality Green (formerly Strontian) Island, Lake Erie, Ohio. Types No. 7462 of my collection. Paratypes in collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

On Middle Sister Island a few specimens of this same high, bandless variety were found. They were too few, however, to make comparative measurements, but they apparently run larger.

This is not "*Pyr. solitaria albina* (W. G. Binney)" of Walker, *Terrestrial Mollusca of Michigan*, 1899, p. 22, without description, as the locality is there given as "Kent Co." In "*An Illustrated Catalogue of the Mollusca of Michigan*," by Bryant Walker, *Rep. State Board Geol. Surv. Mich.*, 1905, p. 492, Binney's figure 268 is copied from the *Manual of American Land-Shells*, p. 254 and the name under the original figure is changed from "Var. *albino*" to "Var. *albina* (Binney)" and the statement is made: "The variety has been reported from Kent county only."[1]

Binney probably never intended to make this a variety. In *Land and Fresh-Water Shells of North America*, Vol. I, p. 71, it is figured with the type as "*Helix solitaria* and albino." In *Terrestrial Mollusca*, Vol. V, it is not listed as a variety in the Catalogue on p. 77, and on p. 156 it is figured separately as "Var. *albino*." If he had intended to describe it formally as a variety, he would surely have given the name a Latin termination. It would seem, therefore, that var. *albina* (W. G. Binney) Walker must be limited to albinos of the typical banded form of the mainland.

Binney's figure was probably drawn from one of the small shells of Strontian Island, as he had them in his collection. No. 38987 of

[1] Dr. Walker has kindly furnished the following description:

Pyramidula solitaria albina Walker.

Pyramidula solitaria albina Walker, Ill. Cat. Moll. Mich., p. 492 (exc. of figure), 1906.

"This form was based on a single example in the DeCamp Collection, (No. 11650 Coll. Walker), from Kent County, Michigan. It is a thin greenish-white shell, slightly tinged with pale horn-color. It is evidently not quite mature, as the lip is thin and sharp. It has 4½ whorls and measures, diam. 21.5, alt. 16 mm. Compared with the variety from Green (Strontian) Island, which was probably the original of the figure copied erroneously from Binney, it is a much thinner shell and differs conspicuously in color."

the Binney collection, now in the National Museum, is labeled "Strontian Isl., and Cunninghams Isl., L. Erie" and under remarks "Albino." Cunninghams is now known as Kelley's Island.

All these shells from Strontian Island were undoubtedly distributed by the late Dr. E. W. Hubbard, who lived for many years at Elyria, O. I have them in the collection of Dr. Jas. Lewis, of Sanderson Smith, and in part of Dr. Hubbard's collection, all from that source. In the A. D. Brown Collection in the Academy of Natural Sciences of Philadelphia, are four specimens, and Brown's label says: "E. W. H."

2. **Pyramidula solitaria roseo-apicata** var. nov.

On North Harbor Island a smaller and still more elevated race with a *pink apex* was found.

Shell small, elevated, very heavy, with the *apical whorls pink*. In color they are generally darker than var. *strontiana*, some being almost chestnut and others brownish straw-color, mottled with chestnut on the upper whorls. Mature shells are mostly largely denuded, the epidermis which remains being in ragged patches. The *pink apex* is a very marked character in this variety and this feature, together with the darker color and smaller size, readily separates it from *strontiana*.

This variety is particularly interesting in showing the gradual loss of the bands. Of one hundred and nine shells collected by the writer seven had two strong bands, fourteen had one or two weak bands and eighty-eight were without bands. Sixty-seven fully mature, unbanded shells were measured, with the following result:

Diam. 22.55, Alt. 17.36 mm., Index, 76.98 average,
" 25.50, " 19.50 " " 76.48 largest,
" 19.50, " 14.00 " " 71.80 smallest and most depressed,
" 21.00, " 17.50 " " 83.33 most elevated,
" 22.14, " 17.00 " " 76.79 average of 7 banded,
" 22.53, " 17.33 " " 76.92 " " 74 shells.
Variation in diam. of unbanded shells from 19.5 to 25.5 or 6.0 mm.
" " alt. " " " " 14.0 " 19.5 " 5.5 "
Sixty bandless shells varied in diam. from 20.5 to 24.5 or 4 mm.
Sixty-four " " " " alt. " 15.5 " 19.0 " 3.5 "

Type-locality North Harbor Island, Lake Erie, Ontario. Types No. 7463 of my collection. Paratypes in collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

The dimensions given for *solitaria* by Binney in the *Manual* are

evidently wrong, as he gives the greater diam. as 25 mm., while Say gives the size as "nearly 1 $\frac{1}{5}$ inch," or about 29 mm., and *The Terrestrial Mollusca* says "over 1¼ inch," or about 32 mm.

3. **Pyramidula solitaria mynesites*** var. nov.

On Mouse Island, a small island at the end of Catawba Id., Ottawa Co., Ohio, Mr. Goodrich found a small form of *solitaria* which is so distinct from all of the other forms of the region that I distinguish it by the above varietal name.

Shell small, solid, straw-colored, with two brown bands, the lower wider and darker than the upper one which is sometimes almost obsolete. Apex pink like var. *roseo-apicata*. Whorls 5½.

Compared with vars. *strontiana* and *roseo-apicata* it is constantly much smaller and intermediate in color, but with the banding of the latter. Over two hundred were collected and measurements of thirty-seven mature shells gave the following results:

Diam.	20.12,	Alt.	14.61	mm.,	Index	72.61	average,	
"	21.00,	"	16.00	"	"	76.20	largest,	
"	18.50,	"	13.50	"	"	72.97	smallest,	
"	20.00,	"	16.00	"	"	80.00	most elevated,	
"	20.50,	"	14.00	"	"	68.30	"	depressed.

Types No. 7232 of my collection. Paratypes in collections of Bryant Walker, Detroit, Mich., and Calvin Goodrich, Toledo, Ohio.

In May 1916 Mr. Goodrich again visited Mouse Island, and collected a large number of *P. solitaria*, many of them juvenile, however. In a letter he says: "The *solitaria* ranged bigger than in my collecting of 1912, but compared with other findngs I believe the form will stand as a dwarf race." The largest shell found this year measures 23.5×18.5 mm., index 78.72, and the smallest, 18.5×12 mm., index 70.28. The average of twenty-nine shells measured is 21.20×15.26 mm., index 71.98. Mr. Goodrich also made a study of the banding of two hundred forty-one shells, adult and young, and found that two were bandless, thirteen had a single band and one hundred seventy-seven had the lower band stronger than the upper.

4. **Pyramidula alternata eriensis** var. nov.

On the islands at the western end of Lake Erie and the islands of Maumee Bay, Michigan, a very heavy, roughly ribbed, elevated,

*From μῦς = *mouse;* νησίτης = *islander.*

dark variety of *alternata* is found, to which the above name may be given. So far as seen it reaches its greatest development on Middle Sister Island.

Shell very dark, flame markings dark chocolate-brown and coalescing into two almost solid bands at the periphery, frequently the bands are hardly separated; below a band of the body-color with irregular flames in the umbilical region. Fully adult shells frequently lose most of the epidermis, but by transmitted light the two bands can be seen at the periphery with the lighter band and color below. Young, bright shells are generally very dark. Albinos are found on all of the islands. Ribs strong and running well down to the umbilicus, regular on the upper whorls, but less so on the body-whorl, being very irregular near the aperture. Body-whorl subcarinate, upper lip considerably flattened, particularly on the shells from Middle Sister Island, where it is frequently as much depressed as in *Circinaria*. Lip thickened in old shells and the parietal callus very heavy, frequently forming a strong ridge. Subscalariform specimens are not uncommon. Whorls six to six and one-half in Middle Sister shells, in those from other islands about five and one-half.

There appears to be a greater tendency to albinism on Middle Sister than on the other islands. Out of one hundred and seventy-six collected by the writer five immature shells are of a uniform straw-color and some of the adults, although badly weathered, seem by transmitted light to be albinos. Others are straw-colored with indistinct flames. Twenty-five to thirty shells, or about 16 per cent. are light-colored.

In the umbilicus of several of the Middle Sister shells the empty pupa-case of a fly, or wasp, was found filling the umbilicus completely and requiring a strong pull to detach it.

Middle Sister Island. 102 fully adult shells measured:

Diam. 21.81, Alt. 14.23 mm., Index, $\frac{A}{D}$ 65.25 average,

"	25.00,	"	17.50	"	"	70.00 largest,
"	19.50,	"	14.50	"	"	74.40 smallest,
"	23.00,	"	17.50	"	"	76.10 most elevated,
"	23.00,	"	13.50	"	"	58.70 most depressed.

Variation in diam. from 19.5 to 25.0 or 5.5 mm.
" " alt. " 12.5 " 17.5 " 5.0 "
Eighty-eight shells varied in diam. from 20.5 to 23.5 or 3 mm.
Ninety " " " alt. " 13.0 " 16.0 " 3 "

Green (Strontian) Island. 86 fully adult shells measured:

Diam. 19.3, Alt. 12.6 mm., Index 66.33 average,
" 21.5, " 13.0 " " 60.47 largest,
" 17.0, " 12.0 " " 70.58 smallest,
" 18.0, " 13.5 " " 75.00 most elevated,
" 20.0, " 11.0 " " 55.00 most depressed.
Variation in diam. from 17.0 to 21.5 or 4.5 mm.
" " alt. " 11.0 " 14.0 " 3.0 "
Eighty-four shells varied in diam. from 17.5 to 21 or 3.5 mm.
Eighty-six " " " alt. " 11.0 " 14 " 3.0 "

North Harbor Island. Shells smaller. 41 varied from 17.5 × 11 mm. to 20.5 × 12 mm., average 19.11 × 12.01 mm., index 62.65, the most elevated having an index of 71.05 and the most depressed of 57.50.

Type-locality Middle Sister Island, Lake Erie, Ontario. Types No. 7464 of my collection, paratypes in collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

5. **Polygyra profunda strontiana** var. nov.

Shell small, elevated, compact, dull-colored; umbilicus small, partly covered by the reflected lip, and contained about six times in the diameter of the shell. Whorls 5.

This variety was noticed by Binney, as in *Land and Fresh-water Shells of North America*, Pt. I, p. 153, in the table of specimens in the Binney and Bland Collection is the following reference: "No. 7946, 2 specimens, Strontian Id., Lake Erie, from W. G. Binney," and under Remarks, "Local var." In *Manual of American Land Shells*, p. 492, in the catalog of the Binney Collection, No. 39527 is from "Strontian Id., L. Erie, Collected by Hubbard, 6 spec., Var."

MEASUREMENTS.

Green (Strontian) Island.

Diam. 23.3, Alt. 14.4 mm., Index, $\frac{A}{D}$ 61.80 average of 103 shells,
" 25.5, " 15.5 " " 60.80 largest,
" 21.0, " 13.5 " " 64.80 smallest,
" 22.0, " 15.0 " " 68.18 most elevated,
" 24.5, " 14.0 " " 57.13 most depressed.
Variation in diam. from 21 to 25.5 or 4.5 mm.
" " alt. " 13 " 16.0 " 3.0 "
Ninety-eight shells vary in diam. from 22.0 to 25.0 or 3 mm.
Eighty-seven " " " " " 22.5 " 24.5 " 2 "
Ninety-four " " " alt. " 13.5 " 15.5 " 2 "

North Harbor Island.

Diam. 23.16, Alt. 14.56 mm., Index 62.87 average of 16 shells.

Middle Sister Island.

Diam. 24.05, Alt. 14.66 mm., Index 60.96 average of 129 shells,
" 27.00, " 16.50 " " 61.10 largest,
" 21.50, " 14.00 " " 65.10 smallest,
" 23.50, " 16.00 " " 68.08 most elevated,
" 25.50, " 14.00 " " 54.90 most depressed.
Variation in diam. from 21.5 to 27.0 or 5.5 mm.
" " alt. " 13.0 " 16.5 " 3.5 "
One hundred eighteen shells vary in diam. from 23 to 26 or 3 mm.
One hundred fourteen " " " alt. " 14 " 16 " 2 "

Of the above 248 shells, 231 or 93.14 per cent. are from 21 to 25 mm. in diam. and 205, or 82.66 per cent., are under 25 mm. The average diam. is 23.5, alt. 14.54 mm., index 61.86.

Type-locality Green (formerly Strontian) Island, Lake Erie, Ohio. Types No. 7466 of my collection. Paratypes in collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

On Put-in-Bay Island, the *profunda* are of the large, flatter, mainland form. They are also brighter in color.

Thirty-eight shells from four localities in Ohio, Illinois, and Ontario were measured, and gave an average of 26.87 × 15.1 mm., index 56.10. Shells from farther south are much flatter, as the average of thirty-two shells from five localities in Kentucky, Virginia, and North Carolina is 28.84 × 14.82 mm., index 51.4. The smallest of these thirty-two shells is 25.5 × 13.5 mm. and the largest 33 × 16.5 mm. The most depressed, excluding abnormal shells, had an index of 46.88 and the most elevated 55.77.

The specimens of *profunda* from Green Island appear to be losing the bands, as out of one hundred and three examined thirty-seven are banded, thirty-two are unicolorous and thirty-four are albinos. The bands are faint to obsolete and generally split, many of the unicolorous shells are so light that they might be called albinos. The large proportion of bandless shells, about 65 per cent., would seem to indicate the formation of a bandless race. On Middle Sister Island the proportion of bandless shells is smaller, as out of one hundred and thirty-four shells twenty-nine are of a uniform brown color, four are straw-colored, four are albinos, sixty-seven have a single brown band and thirty have two or more bands, the lower one usually split, and many

of them have the last season's growth, that is about one-half whorl back of the lip much lighter in color than the remainder of the shell.

6. **Polygyra albolabris goodrichi** var. nov.

Shell elevated, heavy, dark chestnut-color, having a reddish cast when alive, lip brownish in immature shells and flesh-colored in adults. Whorls five and one-half. Compared with the average *albolabris* of the region the lip is narrower and less flattened, and the aperture is slightly more rounded and less oblique. One shell collected by Dr. Walker is dentate and one in my collection very faintly so. The color is so distinct and the shells so much more elevated than normal, that I consider it worthy of varietal rank and take pleasure in associating with it the name of Calvin Goodrich, of Toledo, Ohio, who has done much good work on the molluscan fauna of that most interesting island region.

Forty-eight fully adult shells were measured with the following result:

Diam. 28.24, Alt. 19.44 mm., Index, $\frac{A}{D}$ 68.83 average,
" 30.00, " 22.00 " " 73.33 largest,
" 25.50, " 17.00 " " 66.67 smallest,
" 28.50, " 22.50 " " 78.95 most elevated,
" 26.00, " 16.00 " " 61.53 most depressed.
Variation in diam. from 25.5 to 30.0 or 4.5 mm.
" " alt. " 16.0 " 22.5 " 6.5 "
Forty-five shells vary in diam. from 27.0 to 30.0 or 3.0 mm.
Forty-four " " " alt. " 17.5 " 21.0 " 3.5 "

Type-locality Middle Sister Island, Lake Erie, Ontario. Types No. 7465 of my collection. Paratypes in the collections of Bryant Walker, Detroit, Michigan, and Calvin Goodrich, Toledo, Ohio.

Two or three dead shells found on North Harbor Island belong to this variety.

Walker in "Variation of *Polygyra albolabris* in Michigan," *Proc. Acad. Nat. Sci.*, 1910, pp. 21–40, gives the average size of one hundred and fifty-two shells from Cincinanti, O., as 28.35 × 18.78 mm., index 66. Two hundred and twenty-five shells from various localities in Michigan, gave an average index of 67, and one hundred and twenty-four from Isle Royale, Michigan, an index of 65. I believe that a large series taken from almost anywhere in the interior region will show an average index of not over 66. A series from Bald Porcupine Island, Frenchmen's Bay, Maine, gave an index of about 64.

On the islands under cultivation, and particularly on West Sister Island, which was overrun by large flocks of turkeys, living mollusks were very scarce, while the dead shells indicated that at one time the molluscan population was very large, the ground being covered by the "bones." It is my belief that this destruction is largely due to the turkeys, which scratch up and eat the eggs. Of course the constant tramping of cattle and the destruction of the undergrowth by browsing would destroy large numbers, but the turkeys scratch all around, and even under the fallen trees, where the eggs would be deposited.

A number of dead shells were gathered on West Sister Island, and on cleaning out the dirt with which they were filled many minute species were found. Three of the dead specimens of *solitaria* contained young of from two to two and one-half whorls, there being two young in one of the shells and one in each of the others. Out of others broken young were shaken, but so badly broken that they were merely recognizable as the young of *solitaria*. Does this indicate that, at times, *solitaria* may be viviparous?

EXPLANATION OF PLATE XXXII.

FIG. 1. *Pyramidula solitaria strontiana* Clapp. (Type)
FIG. 2. *Pyramidula solitaria strontiana* Clapp, most elevated form.
FIG. 3. *Pyramidula solitaria strontiana* Clapp, largest specimen.
FIGS. 4–5. *Pyramidula solitaria roseo-apicata* Clapp. (Type)
FIG. 6. *Pyramidula solitaria roseo-apicata* Clapp, back view.
FIGS. 7–8. *Pyramidula solitaria mynesites* Clapp. (Type)
FIGS. 9–10. *Pyramidula alternata eriensis* Clapp. (Type)
FIG. 11. *Pyramidula alternata eriensis* Clapp, very tall specimen.
FIG. 12. *Pyramidula alternata eriensis* Clapp, top view of largest specimen.
FIGS. 13–14. *Polygyra profunda strontiana* Clapp. (Type)
FIG. 15. *Polygyra profunda strontiana* Clapp, showing extreme elevation of spire.
FIGS. 16–17. *Polygyra albolabris goodrichi* Clapp. (Type)
FIG. 18. *Polygyra albolabris goodrichi* Clapp, showing extreme height of spire.